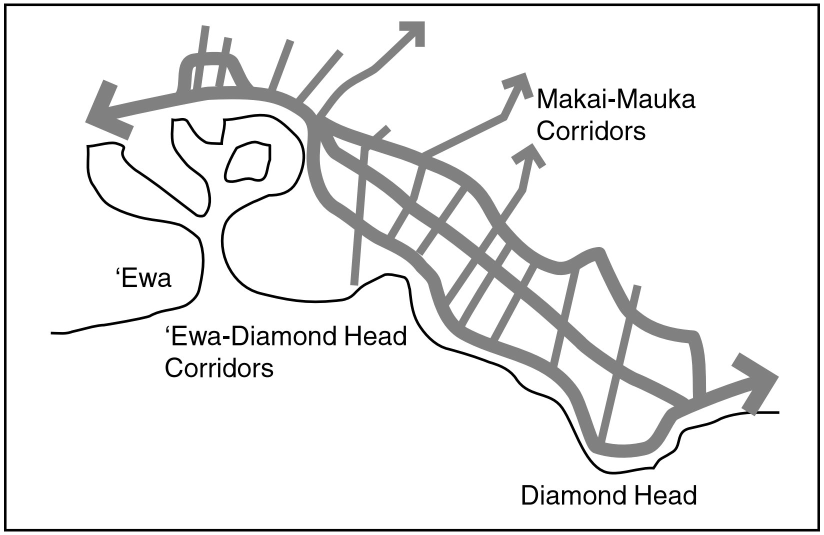


Design Concepts & Standards

Bicycle transportation planning is an emerging field of transportation planning. The American Association of State Highway and Transportation Officials (AASHTO) and the Federal Highways Administration (FHWA) have prepared general guidance in the overall methods and approaches used in designing bicycle transportation systems and this guidance has been incorporated into the *Honolulu Bicycle Master Plan*.

B.1 Regional Bicycle Corridor Concept

The regional bicycle corridor concept provides the structure within which the system of bicycle routes is established. In defining the network of bicycle corridors, the *location* of corridors and the *spacing* of these corridors, with respect to each other, have a significant influence upon the usefulness of a bike route system. Major *origins and destinations* of potential bicycle trips must be identified to ensure routes are available to meet cyclist's needs. *Public input* in identifying corridors and routes is critical to understanding user needs and desires. Finally, the corridor network has to be *connected* to the island-wide system to facilitate intra-regional travel.

Bicycle network planning begins with the understanding that people on bikes want to go to the same places as people in cars. Therefore, the City's existing street network provides an excellent framework for identifying the major travel corridors. The City's major ‘Ewa-Diamond Head arterial streets are spaced about a mile apart on average. The major Mauka-Makai streets are also spaced about a mile apart. The close spacing of the City's major streets means that most residents of the City reside within several bicycle-minutes of a major street.

Based on public input, analysis of existing travel patterns, and the location of major employment and recreation centers, two major travel corridor types are recognized: ‘Ewa-Diamond Head Corridors (Makai, Central and Mauka Corridors), and Mauka-Makai Corridors. The ‘Ewa-Diamond Head Corridors include the City's principal arterial streets such as King St., Beretania St., Ala Moana Blvd., and Nimitz Hwy. which carry the highest volume of bicycle traffic.

The Mauka-Makai Corridors provide local access to the major ‘Ewa-Diamond Head Corridors, as well as major access to several of the universities and colleges within the planning area, such as UH Mānoa and Honolulu Community College. The Mauka-Makai Corridors also include the Kapālama, Nuʻuanu, and Mānoa-Pālolo Stream corridors.

The objective and concept is to develop bike routes within each of the major travel corridors. The following tables summarize recommended projects by major corridor.

The Makai Bike Corridor includes 26.6 miles of projects which will provide a continuous route across the City near the water. The facilities include at least one continuous bike lane, and at several locations, a choice of bike lanes and shared-use path facilities. The Makai Bike Corridor could become the urban leg of an around-the-island bike corridor.

Table B.1: Makai Bike Corridor Projects

Proj. No.		Facility	Type	Length (miles)	Total Cost (1,000's)
2	25	Ala Moana Blvd. (Nimitz-Kalākaua)	lane	2.7	$9,535
LP	3	Ala Moana Park to Ala Wai Canal	sup	0.2	110
LP	21	Ala Moana Blvd. (Holomoana-Kālia)	lane	0.1	65
LP	11	Ala Wai Blvd.	sup/lane	1.6	4,780
LP	1	Aloha Tower to Waterfront Park	sup	0.7	695
LP	8	Date St. (Lāʻau-Kapahulu)	sup	0.6	235
LP	18	Diamond Head Rd. (Makapuʻu-Ruger Pk)	lane	1.0	70
LP	10	Diamond Head Rd. (Ruger Pk-Ponimōʻī)	lane	1.4	3,755
LP	20	Holomoana St. (Ala Wai Yacht Harbor)	lane	0.6	100
LP	4	Kalākaua Ave. Bridge	x-walk	200 ft.	310
LP	24	Kalākaua Ave. (Beretania-Kapahulu)	lane	2.2	365
LP	5	Kalākaua Ave. to McCully St.	sup	0.2	335
LP	22	Kālia Rd. (Ala Moana-Saratoga)	lane	0.4	630
2	5	Kam. Hwy. (H-2-Stadium)	lane	3.8	13,005
FR	5	Kam. Hwy. (Valkenburgh-Aloha Stadium)	lane	2.6	785
CA	25	Kīlauea Ave. (Waiʻalae-18th)	lane	1.6	280
LP	6	McCully St. Bridge (over the Ala Wai)	x-walk	200 ft.	310
LP	7	McCully St. to Date St.	sup	0.9	260
FR	7	Nimitz Hwy. (H-1 Viaduct)	lane	2.5	295
FR	8	Nimitz Hwy. (Waiakamilo Detour)	lane	0.8	130
FR	9	Nimitz Hwy. (H-1 Viaduct to Waiakamilo)	lane	1.1	950
LP	9	Pākī Ave. (Kapahulu-Monsarrat)	lane	0.3	545
LP	9a	Pākī Ave. (Monsarrat-Diamond Head Rd.)	lane	0.7	920
CA	29	Pearl Harbor Bike Path to LCC	sup	0.2	140
LP	2	Waterfront Park to Ala Moana Park	lane	0.3	80
		Subtotal		**26.6**	**$38,685**

Central Bike Corridor projects (18.4 miles) cut right through the center of the City, extending from Kāhala to Pearl Harbor. Facilities are all bike lanes with the exception of the Young Street Park Boulevard (a redesigned street).

Table B.2: Central Bike Corridor Projects

Proj. No.		Facility	Type	Length (miles)	Total Cost (1,000's)
2	14	‘Ahua St. (Pūkōloa-Kikowaena)	lane	0.1	$40
FR	15	Beretania St.	lane	3.3	2,010
CA	12	Coyne St. (University-Isenberg)	route	0.3	20
FR	12	Hotel St. (Alapa‘i-Ward)	lane	0.2	235
FR	11	Hotel St. (River-Richards)	route	0.5	125
2	13	Kikowaena St. (Pūkōloa-Kaua)	lane	0.3	110
LP	15	Kuilei St.	lane	0.3	440
2	24	North King St. (Beretania-Middle)	lane	1.6	1,405
FR	16	Old Wai‘alae Rd. (Wai‘alae to UH Quarry)	lane	0.3	125
FR	16a	Old Wai‘alae Rd. Bridge (over H-1)	lane	0.1	40
2	15	Pūkōloa (‘Ahua-Salt Lake Blvd.)	lane	0.3	110
2	22	Salt Lake Blvd. (Kam. Hwy.-Pu‘uloa)	lane	3.5	365
FR	13	South King St.	lane	3.3	2,010
CA	10	Univ. Lower Quarry (Old Wai‘alae-Varsity)	lane	0.3	50
CA	11	Varsity Pl. (Univ.-UH Lower Quarry)	route	0.1	50
FR	18	Wai‘alae Ave. (17th-Kalaniana‘ole)	lane	0.8	335
FR	17	Wai‘alae Ave. (Old Wai‘alae-17th)	lane	1.5	450
LP	13	Young St.	park blvd.	1.6	6,700
		Subtotal		**18.4**	**$14,620**

Mauka Bike Corridor projects (12.5 miles) extend from Dole Street by the UH Mānoa Campus, up and over Red Hill, and up along Moanalua and Noelani Streets in the ‘Aiea / Pearl City area. The segment up and over Red Hill is a multi-use path. The rest of the facilities are bike lanes.

Table B.3: Mauka Bike Corridor Projects

Proj. No.		Facility	Type	Length (miles)	Total Cost (1,000's)
3	9	Alapa‘i St. (‘Iolani-Spencer)	lane	0.2	$40
CA	14	Dole St. (EW Rd.-St. Louis)	lane	0.5	95
CA	13	Dole St. (University-EW Rd.)	lane	0.5	110
3	8	‘Iolani Ave. (Alapa‘i-N. School)	lane	0.4	350
2	18	Kaua St. (Middle-Moanalua Gardens)	lane	0.8	530
2	16	Moanalua Gardens	sup	0.4	365
2	7	Moanalua Rd. (‘Aiea Hts.-Ka‘ahumanu)	lane	1.5	295
2	17	Moanalua Rd. (Moanalua Gdns-Icarus)	sup	0.9	1,420
2	6	Noelani St. (Ka‘ahumanu-Waimano Home)	lane	1.2	125
3	7	North School St. (‘Iolani-Middle)	lane	2.5	1,850
3	1	Red Hill (Icarus Way-Ulune)	sup	0.8	1,295
3	10	Spencer St. (Alapa‘i-Wilder)	lane	0.3	125
2	9	Ulune St. (Hālawa Valley Rd.-‘Aiea Hts.)	lane	1.1	100
3	11	Wilder Ave. (Dole-Spencer)	lane	1.4	380
		Subtotal		**12.5**	**$7,080**

Mauka-Makai Bike Corridor projects (34.0 miles) constitute the largest number of road segments. Most are relatively short segments, indicative of the narrow coastal plain upon which the City is built. The three canal multi-use paths (Kapālama, Nuʻuanu, and Mānoa-Pālolo) represent some of the longer segments. Gateway improvements to the Pearl Harbor Bike Path represent some of the smaller segments.

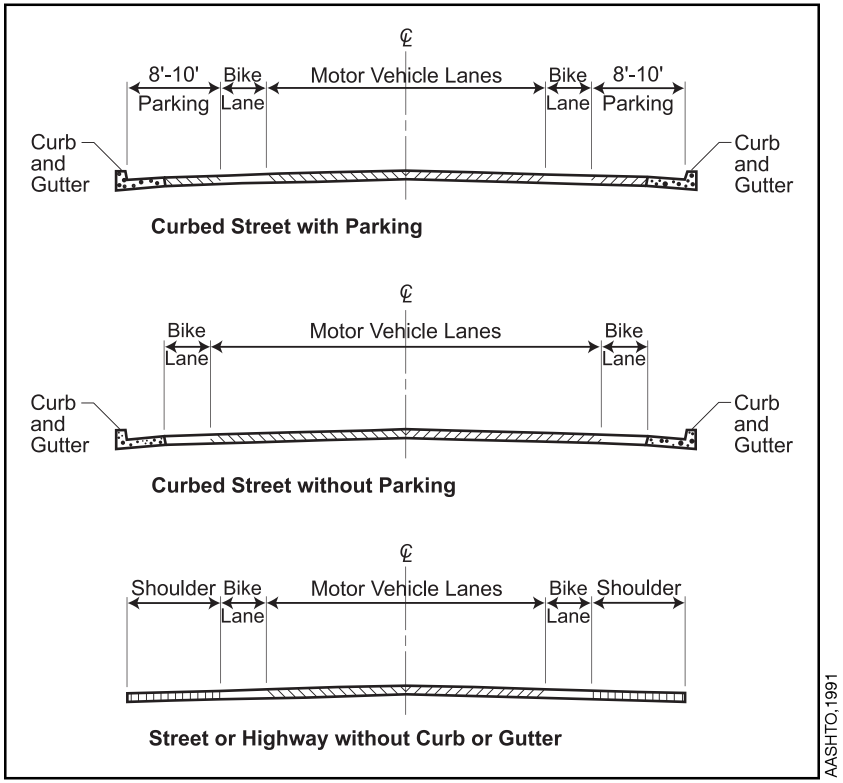
Table B.4: Mauka-Makai Bike Corridor Projects

Proj. No.		Facility	Type	Length (miles)	Total Cost (1,000's)
CA	21	10th Ave. (Alohea-Waiʻalae)	route	0.6	$ 65
3	12	10th Ave. (Waiʻōmaʻo-Waiʻalae)	route	1.4	110
CA	22	16th Ave. (Waiʻalae-Kīlauea)	route	0.6	65
2	8	ʻAiea Hts. Dr. (Ulune-Moanalua)	lane	0.1	50
CA	28	Alakawa St. (Nimitz-Dillingham)	lane	0.5	80
2	10	Āliamanu Dr. (Moanalua-Bougainville)	lane	1.0	80
CA	20	Alohea St.	lane	0.3	50
2	11	Bougainville (Āliamanu-Radford)	lane	0.7	65
2	26	Cooke St. (Ilalo-Hotel)	lane	0.8	130
LP	12	Fort St. Mall	route	0.4	80
2	4a	Honomanū St. (Moanualua-Kam)	lane	0.1	500
LP	14	Isenberg St. (Coyne-King)	lane	0.2	470
2	3	Kaʻōnohi St. (Kamehameha-Laelua)	lane	1.5	100
2	2	Kaʻahumanu St. (Kam.-Komo Mai)	lane	1.0	95
2	4	Kaʻamilo St. (Kulawai-Honomanū)	lane	1.5	130
3	6	Kam. IV Rd. (N. School-Likelike)	lane	0.7	110
3	15	Kāneali'i (Lusitana-Kapalu)	route	0.6	290
CA	27	Kapālama Stream (Nimitz-N. King)	sup	0.6	1,375
CA	4	Kapahulu Ave. (Ala Wai-Campbell)	lane	0.4	80
CA	5	Kapahulu Ave. (Campbell-Charles)	lane	0.5	170
CA	6	Kapahulu Ave. (Charles-Waiʻalae)	lane	0.4	140
CA	3	Kapahulu Ave. (Kalākaua-Ala Wai)	lane	0.5	100
3	16	Kapalu (Pauoa-Kāneali'i)	route	0.1	95
LP	16	Kapiʻolani Blvd. (Kuilei-S. King)	lane	0.4	235
3	2	Lagoon Dr.	lane	2.4	145
3	4	Liliha St. (N. King-Wyllie)	lane	1.4	365
3	13	Lusitana St. (ʻIolani-Pauoa)	route	0.4	405
CA	19	Makapuʻu Ave.	lane	0.3	35
LP	17	Mānoa-Pālolo Stream (Ala Wai-Kapiʻolani)	sup	0.4	725
CA	1	Mānoa-Pālolo Stream (Kapiʻolani-Dole)	sup	0.4	725
CA	7	McCully St. (Ala Wai-Wilder)	lane	0.8	520
CA	8	McCully St. (Bridge over H-1)	lane	0.2	2,795
CA	9	Metcalf St. (Wilder-University)	lane	0.4	85
2	20	Middle St. (Bridge over H-1)	lane	200 ft.	10
2	21	Middle St. (Kaua-N. School)	lane	0.7	65
2	19	Middle St. (Nimitz-N. King)	lane	0.5	95
CA	23	Monsarrat Ave. (Kalākaua-Pākī)	lane	0.4	70
CA	24	Monsarrat Ave. (Pākī-Makapuʻu)	lane	0.8	455
3	5	Nuʻuanu Stream (Nimitz-Kuakini)	sup	0.8	1,530
3	14	Pauoa Rd. (Lusitana-Kapalu)	route	0.6	290
		Pearl Harbor Bike Path Gateways:			
FR	2	@ Blaisdell Park	sup	50 ft.	25
FR	3	@ Kanuku St.	sup	0.2	140
FR	1	@ Lehua Ave.	lane	0.1	65
FR	4	@ Pearl Kai Center	sup	0.2	140
FR	5	@ McGrew Point	sign		10
2	27	Pensacola St. (Waimanu-Wilder)	route	1.0	235
2	28	Piʻikoi St. (Ala Moana-Wilder)	route	1.2	245
2	12	Puʻuloa Rd. (Nimitz-Moanalua)	lane	1.3	275
FR	6	Radford Dr. (Bougainville-Kamehameha)	lane	0.4	85
FR	10	River St. (Nimitz-Beretania)	lane	0.1	85
2	23	Sand Island Bridge	lane	0.2	70
3	3	Sand Island SUP (Keʻehi Lagoon to Sand Island)	sup	1.3	1,055
LP	23	Saratoga Rd. (Kālia-Kalākaua)	lane	0.4	640
CA	2	St. Louis Hts. Dr. (Waiʻalae-Dole)	lane	0.1	125
CA	17	Univ. Ave. (Dole-Maile Way)	lane	0.4	130
CA	16	Univ. Ave. (Varsity-Dole (mauka dir.))	lane	0.3	140
CA	18	Univ. Upper Fire Rd. (EW Rd.-Pāmoa)	sup	0.2	190
CA	15	Univ.-Dole Intersection Improvements	int.		140
2	1	Waimano Home Rd. (Kam.-Komo Mai)	lane	1.2	305
		Subtotal		**34.0**	**$17,080**

B.2 Design Treatments

There are several basic types of bikeway facilities. These include **bike lanes**, **bike routes**, and **bike paths**. The first two are on-road facilities and the last is off-road.

Bike lanes typically occupy the outside / curb lane of the street, and are identified by a continuous white stripe placed 4-6 feet from the gutter pan or parking lane. Bike routes are posted along streets with **wide curb lanes** or **shared lanes** where there is less traffic.

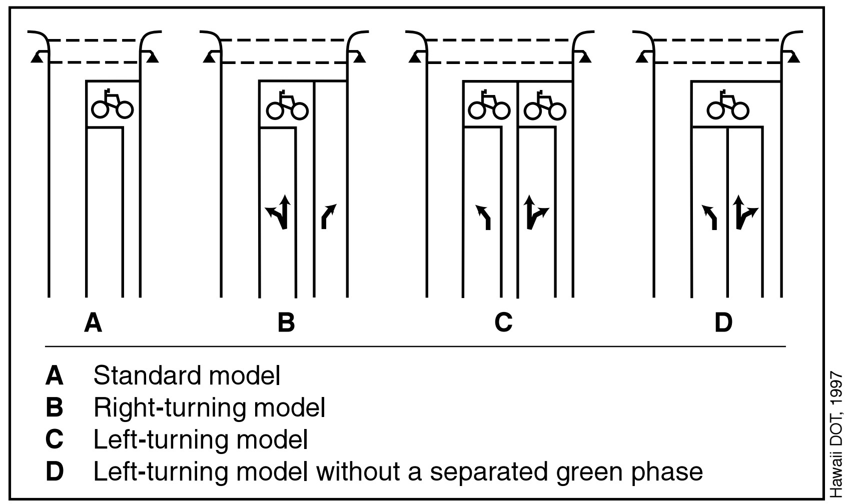


Typical Bicycle Lane Cross Section

In areas where bike lanes are the preferred treatment but right-of-way and roadway widths are insufficient, a **bike logo stencil** can be placed on the curb lane pavement at regular intervals. This treatment provides slightly better protection for the bicyclist than no treatment at all because it alerts the motorist that the lane should be shared with bicycles.

At intersections, it is sometimes difficult for a motorists and bicyclists alike to know where they should be waiting until a traffic signal changes from red to green. **Advanced stop lanes** for bicyclists can be painted refuge islands that define space for bicyclists to queue.

Bike paths are now called **shared-use paths** in recognition of the many joggers, walkers, and in-line skaters using them. They are typically removed from the road right-of-way entirely, located adjacent to the roadway or within parks and other scenic areas.

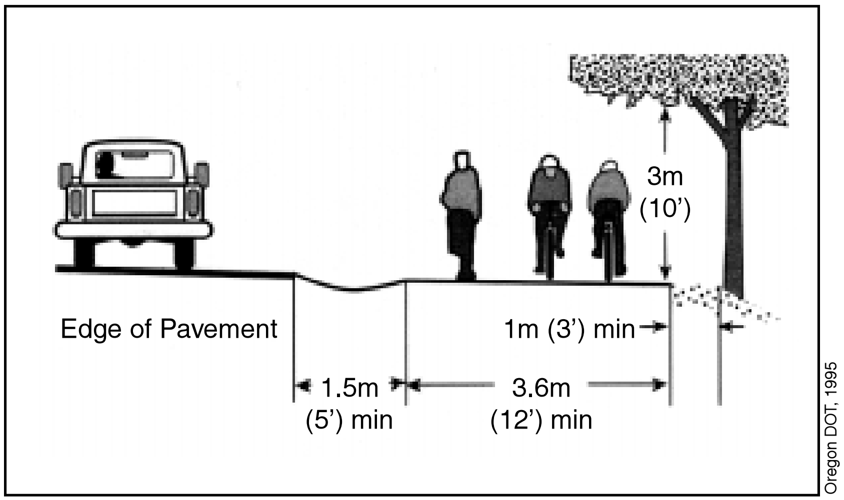


Advanced Stop Lanes

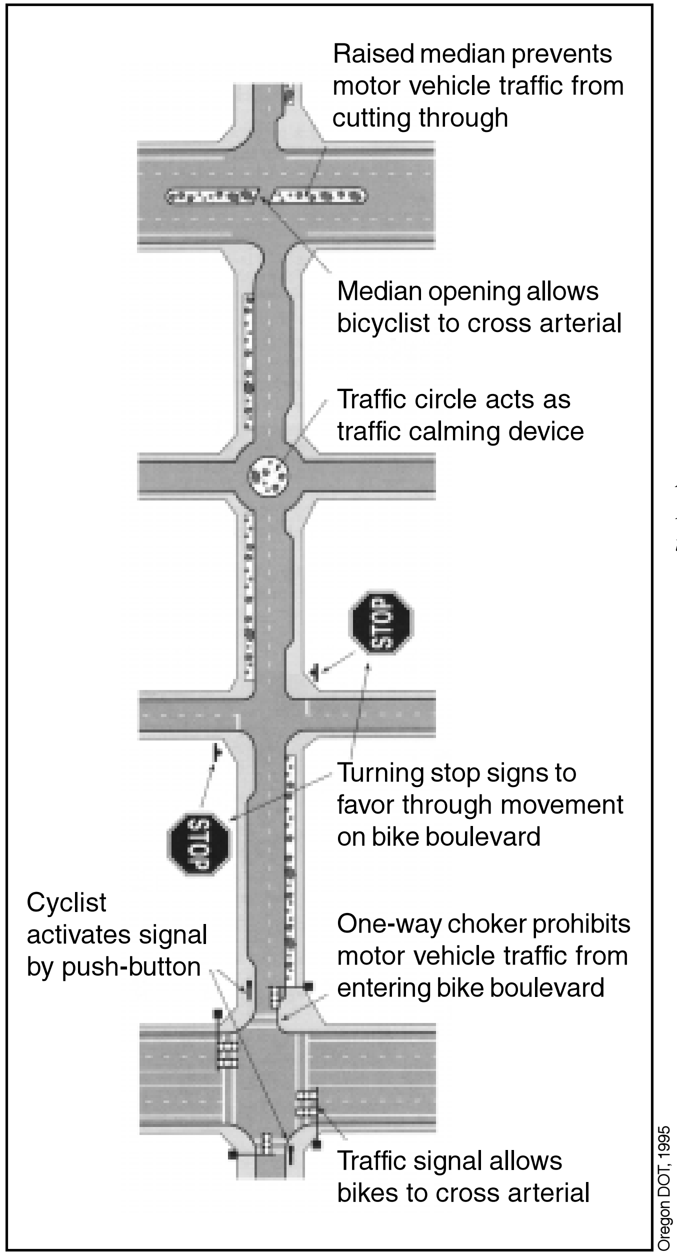
In Honolulu, as with many developed urban areas, the streets are the only means of providing continuous travelways for bicycles. Shared-use paths can provide local access and recreation, but there is simply not enough available land to create an extensive system of off-road facilities.

The **bicycle boulevard** or **park boulevard** is a refinement of the shared lane concept where the operation of a local street is modified to function as a through street for bicycles while maintaining local access for motor vehicles. Typical bike / park boulevard design treatments include cyclist-activated traffic signals, traffic circles to calm traffic, medians in the cross streets for refuge, and other physical improvements to reduce motor vehicle “shortcutting. ”

FHWA has adopted a method to identify the type of bicycle facility indicated in a specific situation. HDOT is adapting



Shared-use path



Park / Bicycle Boulevard typical plan

the method for use in Hawai‘i. Key parameters considered in determining the appropriate treatment include the volume and average speed of motor vehicle traffic along a proposed bicycle route, mix of traffic, presence or absence of on-street parking, land use, and the available space in the right-of-way. Streets with little traffic or slow-moving traffic, such as on many of our local residential streets, are already bicycle-friendly; the major concern in our neighborhoods is enforcement of motor vehicle speeds.

AASHTO and FHWA recognize three groups of cyclists in the design process:

- A - advanced cyclists;
- B - basic cyclists; and
- C - children cyclists.

Recommended roadway design treatments and widths should be based on the Group B/C riders. The minimum design treatment should be based on the Group A riders. An example of the difference between design recommendations is shown in Table B.5, representing a fairly typical condition along Honolulu streets.

The example takes a street with an average daily traffic volume (ADT) between 3,000 and 10,000 vehicles per travel lane and posted speeds of 25 MPH and 35 MPH, a condition which characterizes most of the arterial and collector streets in urban Honolulu. This range of ADT is generally considered as representing “medium” traffic volume.

Table B.5: Recommended Design Treatment*

	Posted Speed Limit**	
Design Group	**25 MPH**	**35 MPH**
A	14’ Wide Curb Lane	4’ Bike Lane
B/C	5’ Bike Lane	6’ Bike Lane

Assumes average daily traffic (ADT) = 3,000-10,000 vehicles per lane

* No on-street parking condition; add extra foot if parking is permitted, up to a maximum of 6 feet.

** Assumes average speed is 10 MPH > posted speed.

The recommended roadway treatment for the 25 MPH street is a 5-foot wide bike lane to accommodate the B/C rider group. The minimum treatment is a 14-foot wide curb lane to accommodate the A rider group.

Note that as vehicle speed increases, so does the level of treatment required. For example, the B/C bike lane increases from 5 to 6 feet wide as the posted speed increases from 25 MPH to 35 MPH.